

PCT

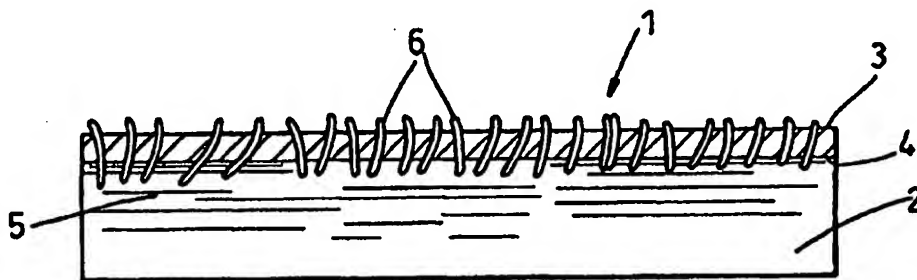
WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification 7 : E04F 15/10, D06N 7/00</p>	<p>A1</p>	<p>(11) International Publication Number: <b>WO 00/42274</b> (43) International Publication Date: 20 July 2000 (20.07.00)</p>
<p>(21) International Application Number: PCT/GB00/00056 (22) International Filing Date: 11 January 2000 (11.01.00) (30) Priority Data: 9900577.9 13 January 1999 (13.01.99) GB (71) Applicant (for all designated States except US): ALTRO LIMITED [GB/GB]; Works Road, Letchworth, Hertfordshire SG6 1NW (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): SHORTLAND, Adrian, John [GB/GB]; 23 Claines Road, Northfield, Birmingham B31 2EE (GB). MASTERS, Karen, Alexandra [GB/GB]; 5 Arwood Mews, Baldock, Hertfordshire SG7 6LA (GB). (74) Agent: BARKER, Brettell; 138 Hagley Road, Edgbaston, Birmingham B16 9PW (GB).</p>	<p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>	

(54) Title: NON STAIN FLOORING



(57) Abstract

A flooring material (1) comprises a base portion (2) having a coating portion (3) which imparts improved stain resistance to the flooring material (1) and is positioned in contact with an upper surface of the base portion (2). The coating portion (3) creates an upper surface of the flooring material (1). A particulate material (6) is embedded in the coating material (3) and at least partially penetrates the base portion (2). The particulate material (6) provides a roughened effect to the upper surface of the flooring material (1) and protects the coating from wear. The coating (3) merges into the base portion (2) where they meet at joint (4) to form a stratified portion (5).

BEST AVAILABLE COPY

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LJ	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SR	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

## NON STAIN FLOORING

The present invention relates to the treatment of flooring to improve stain resistance and in particular to flooring with enhanced slip resistance and  
5 especially PVC flooring with enhanced slip resistance treated to improve stain resistance and to a method of imparting improved stain resistance to flooring, particularly PVC flooring with enhanced slip resistance.

To provide enhanced slip resistance flooring is generally manufactured  
10 having a roughened surface which can be created by embossing the surface or by the addition of particulate material to the main component of the flooring during manufacture.

The roughened surface of the flooring increases the risk of dirt being  
15 trapped on the surface. The dirt, depending on its nature, can be compatible with components of the flooring resulting in absorption of the dirt into the surface giving rise to a stain.

It is known to apply a coating to a cured floor with enhanced slip resistance  
20 to impart increased stain resistance. However, the application of such a coating generally reduces any surface roughness and thus decreases the slip resistance of the floor.

A particulate material can be sprinkled on top of the coating applied to the  
25 cured flooring to impart slip resistance. However the coating applied is generally thin and adhesion of the particulate material is thus reduced. Such floorings generally lose their non-slip properties quickly as the particulate material becomes dislodged from the coating.

The present invention provides a flooring material comprising a base portion, a coating portion, imparting improved stain resistance to the flooring material, being positioned in contact with an upper surface of the base portion and creating an upper surface of the flooring material and a  
5 first particulate material embedded in the coating portion and at least partially penetrating the base portion to provide a roughening effect of the upper surface of the flooring material for enhanced slip resistance and resistance to wear.

10 We are therefore able to provide a flooring with enhanced slip resistance having improved stain resistance without affecting the effectiveness as the life of non-slip properties which are achieved by the particulate material.

Preferably the flooring material is a plastics flooring material, for example,  
15 PVC, modified olefin/olefin copolymer, plasticised acrylic, polyester.

Preferably, the base portion comprises a plastics material such as a PVC plastisol material. The base portion may include a further particulate material dispersed therein. The further particulate material may be  
20 aluminium oxide or any other suitable grit. The base portion may contain a pigment. The base portion may include one or more reinforcing supports, the supports are preferably glass fibre reinforced non-woven supports.

The base portion may be made up of one or more layers of plastics material,  
25 preferably up to three layers are envisaged.

The coating portion of the flooring material of the present invention provides improved stain resistance to the flooring material.

It is believed that the coating creates a barrier between the upper surface of the flooring material and the base portion thus preventing exposure of the base portion to possible stainants. The coating may further prevent migration of components of the base portion to the upper surface of the flooring material where contact with possible stainants could occur.

The first particulate material being embedded in the coating portion and penetrating the base portion means that the coating portion does not destroy the non-slip properties of the flooring material and the first particulate material is less likely to become dislodged thus prolonging the life of the non-slip properties of the flooring material.

The first particulate material is known as grit can be any one or more of a number of types of hard particles including silicon carbide, silicas (quartz or coloured/natural sands or flints), aluminium oxide and emery.

The use of a further particulate material throughout the base portion further prolongs the non-slip properties of the flooring material during wear.

The base portion of the flooring material may further contain pigmented PVC chips, quartz chips or other decorative additives to add a decorative effect to the flooring material.

The coating portion preferably merges into the base portion to some extent where the portions meet providing an amount of the coating portion in the base portion, this amount of coating portion preferably decreases as the distance from the meeting of the base portion and the coating portion increases.

The merging of the coating portion into the base portion provides some improved stain resistance in the base portion even after the coating portion has been worn away.

- 5 The coating portion may comprise any conveniently available thermoplastic material or, alternatively, thermoset material.

The present invention further provides a method of making a flooring material comprising a base portion, a coating portion imparting improved stain resistance to the flooring material and positioned on an upper surface of the base portion and forming an upper surface of the flooring material and a first particulate material embedded in the coating portion and at least partially penetrating the base portion to provide a roughening effect to the upper surface of the flooring material for enhanced slip resistance and protection from wear, the method comprising the steps of:-

- 15 a) mixing together the components of the base portion;  
b) spreading the mixed components of the base portion on a surface;  
c) carrying out at least one application of components of the coating portion in powder form to the components of the base portion;  
20 d) carrying out at least one application of a first particulate material to the components of the base portion before or after applying the components of the coating portion in powder form;  
e) heating the powder coated base portion to cause the powder coating to  
25 form a film.

Preferably the components of the base portion form a paste when mixed.

The paste is preferably spread on the surface at a controlled thickness, preferably a blade is used to spread the paste at a controlled thickness.

When the powder coated paste is heated the powder coating preferably melts and flows to form the film.

- 5 If the powder coating is a thermoplastic material the application of heat in step e) simply melts the coating and allows it to flow and form a film.

If the powder coating is a thermosetting material the application of heat in step e) cures the thermosetting material.

10

The application of heat in step e) may also serve to gel and cure the base portion where the base portion comprises a PVC plastisol material.

- 15 Preferably the components of the coating portion are applied to the paste while it is wet. Alternatively the components of the coating portion may be applied to the base portion after it has been cured.

- 20 Applying the components of the coating portion as a powder to a wet paste is advantageous as the components of the coating portion can blend into the wet paste to some extent so that some of the components of the coating portion are present in the wet paste, and therefore the base portion of the flooring material, in decreasing amounts as the distance from the surface of the paste, is increased. The effect is a stratified coating which imparts improved stain resistance even when the coating portion has become worn.

25

- However the components of the coating portion can be applied to the base portion after it has been cured. In this case the components of the coating will not blend with the base portion to give a stratified effect but the advantages of the coating present on the surface of the base portion will still be achieved.
- 30

Some of the coating portion in powder form can be mixed with the components of the base portion.

- 5 The application of the first particulate material to the powder coated wet paste allows the particulate material to be pressed by embossing through the coating into the paste. This is difficult if the base portion has been cured before coating, but it is possible if the base portion has not set completely.
- 10 The application of the first particulate material after the components of the coating portion in powder form will reduce the rate of sinkage of the particulate material into the wet paste thus allowing reproducible deposition of first particulate material by mass per unit area.
- 15 The components of the base portion preferably comprise a plastics material such as a PVC plastisol. A further particulate material such as aluminium oxide may be included as a component of the base portion. The PVC plastisol may contain a pigment. The base portion may comprise one or more layers of a plastics material.
- 20 A dressing of, for example, silicon carbide may be added to the paste spread at a controlled thickness to confer further slip and wear resistance and give some aesthetic properties. A variety of particles or chips such as PVC chip particles or coloured quartz particles may be added to the paste spread at  
25 controlled thickness by, for example, sprinkling the particles from above.

The powder coated paste is heated, most preferably in an oven, to melt the powder coating.



The product is preferably cured for 1-10 minutes, most preferably 3 minutes, at 150-220°C, most preferably 190°C.

5 Preferably the product is embossed. Embossing preferably takes place while the product is still hot and soft after curing and involves the application of pressure preferably by means of a roller.

The components of the coating portion in powder form may be applied by a sprinkle system, a roller pick-up/brush off type system or a spray system.

10

More than one application of the components of the coating portion in powder form may be necessary.

15

More than one application of the first particulate material is possible.

The presence of the coating portion is likely to reduce water absorption of the flooring material of the present invention. The presence of the coating portion also reduces the amount of volatile organic compounds given off.

20 The present invention will now be described by means of example only with reference to the drawings in which:

Figure 1 shows a cross sectional view of a flooring material of the present invention.

25

Figure 1 shows a cross section of a portion of flooring material 1 having a base portion 2 and a coating portion 3 wherein the coating portion 3 merges into the base portion 2 where they meet 4 to form a stratified portion 5.

The grit like particulates 6 are embedded in the coating portion 3 and penetrate the base portion 2.

The following examples are illustrative of the present invention:

5

a plastisol paste typically comprising:

	Phr (parts per hundred of resin)
PVC powder	100
Plasticiser	30-70
Mineral filler	0-100
Thermal stabiliser	1-3
Pigment	1-6

is produced in a known way. Other additives such as rheology modifiers,  
10 biocides, uv stabilisers etc. may also be used. Grits of the appropriate particle size are added at the required level. The paste produced may then be treated in a variety of ways some of which are covered by the following examples:

#### 15 Example 1

Powder is blended with the paste at an addition level of 1% (w/w) and the paste is spread coated at 2 mm by knife over bed on to a non-woven support. Powder is then applied to the surface at the required application  
20 rate ( $50 \text{ gm}^{-2}$ ). Particles of silicon carbide and coloured quartz are each scattered on the surface at the rate of  $100 \text{ gm}^{-2}$ . The paste is then gelled for 3 minutes at  $160^\circ\text{C}$ . Further powder at the rate of  $50 \text{ gm}^{-2}$  is applied and further silicon carbide is applied at the rate of  $100 \text{ gm}^{-2}$ . The product is then fused at  $190^\circ\text{C}$  for 3 minutes and embossed.

In this example the powder is included in and on the surface of the wet paste and a stratified effect is achieved as the powder coating merges with the paste.

5

### Example 2

Powder is blended with the paste at an addition level of 1% (w/w). The paste is spread coated at a thickness of 2 mm by knife over roller over bed on to a non-woven support. Particles of silicon carbide and coloured quartz are each scattered on the surface at the rate of  $100 \text{ gm}^{-2}$ . The paste is then gelled for 3 minutes at  $170^{\circ}\text{C}$ . Powder at the rate of  $50 \text{ gm}^{-2}$  is applied and further silicon carbide is applied at the rate of  $100 \text{ gm}^{-2}$ . The product is then fused at  $190^{\circ}\text{C}$  for 3 minutes and embossed.

15

In example 2 the powder is applied over a cured PVC base layer having quartz and silicon carbide and further powder therein prior to application of further silicon carbide. Stratification of the powder throughout the product will not occur due to the powder being applied to the cured base layer.

20

### Example 3

Powder is blended with the paste at an addition level of 1% (w/w). The paste is spread coated at a thickness of 2 mm by knife over bed on to a non-woven support. The paste is then gelled for 3 minutes at  $160^{\circ}\text{C}$ . Powder at the rate of  $50 \text{ gm}^{-2}$  is applied and particles of silicon carbide are applied at the rate of  $100 \text{ gm}^{-2}$ . The product is then fused at  $190^{\circ}\text{C}$  for 3 minutes and embossed.

25

In example 3 the powder is applied over a cured PVC base layer having no grits therein prior to application of silicon carbide. Stratification will not be achieved for the reasons set out in Example 2.

#### 5    **Example 4**

Powder is blended with the paste at an addition level of 1% (w/w) The paste is spread coated at 2 mm by knife over roller on to a non-woven support. Particles of silicon carbide and coloured quartz are each scattered on the  
10    surface at the rate of  $100 \text{ gm}^{-2}$ . The paste is then gelled for 3 minutes at  $160^{\circ}\text{C}$ . Powder is applied at the rate of  $50 \text{ gm}^{-2}$ . The product is then fused at  $200^{\circ}\text{C}$  for 2 minutes and embossed.

In example 4 the powder is applied over a cured PVC base layer having  
15    silicon carbide and quartz therein. Again stratification will not be achieved.

#### **Example 5**

The paste is spread coated at 2 mm by knife over roller on to a non-woven  
20    support. Powder is applied at the rate of  $50 \text{ gm}^{-2}$ . Particles of silicon carbide and coloured quartz are each scattered on the surface at a rate of  $100 \text{ gm}^{-2}$ . The product is then fused at  $200^{\circ}\text{C}$  for 2 minutes and embossed.

In example 5 the powder is applied to a wet PVC paste prior to the  
25    application of silicon carbide and quartz and stratification of the powder throughout the product and is likely to occur.

**CLAIMS:**

1. A flooring material comprising a base portion, a coating portion imparting improved stain resistance to the flooring material being positioned in contact with an upper surface of the base portion and creating  
5 an upper surface of the flooring material, and a first particulate material embedded in the coating portion and at least partially penetrating the base portion to provide a roughening effect of the upper surface of the flooring material for enhanced slip resistance and protection from wear.
- 10 2. A flooring material according to claim 1 wherein the flooring material is a plastics flooring material.
3. A flooring material according to claim 2 wherein the plastics flooring material is PVC, a modified olefin/olefin copolymer or a  
15 plasticised acrylic or polyester polymer.
4. A flooring material according to any preceding claim wherein the base portion comprises a PVC plastisol material.
- 20 5. A flooring material according to any preceding claim wherein the base portion includes a further particulate material dispersed therein.
6. A flooring material according to claim 5 wherein the further particulate material is aluminium oxide.
- 25 7. A flooring material according to any preceding claim wherein the base portion contains a pigment.
8. A flooring material according to any preceding claim wherein the  
30 base portion includes one or more reinforcing supports.

9. A flooring material according to claim 8 wherein the supports are glass fibre reinforced non-woven supports.
- 5 10. A flooring material according to any preceding claim wherein the base portion is made up of one or more layers of plastics material.
11. A flooring material according to claim 10 wherein the base portion comprises up to three layers of plastics material.
- 10 12. A flooring material according to any preceding claim wherein the first particulate material is any one or more of a number of types of hard particles including silicon carbide, silicas, aluminium oxide, emery and flint.
- 15 13. A flooring material according to any preceding claim wherein the base portion of the flooring material contains pigmented PVC chips, quartz chips or other decorative additives to add a decorative effect to the flooring material.
- 20 14. A flooring material according to any preceding claim wherein the coating portion merges into the base portion where the portions meet providing an amount of the coating portion in the base portion.
- 25 15. A flooring material according to claim 14 wherein the amount of coating portion merged into the base portion decreases as the distance from the meeting of the base portion and the coating portion increases.

16. A flooring material according to any preceding claim wherein the coating portion comprises any conveniently available thermoplastic material or thermoset material.

5 17. A method of making a flooring material comprising a base portion, a coating portion imparting improved stain resistance to the flooring material and positioned on an upper surface of the base portion to form an upper surface of the flooring material and a first particulate material embedded in the coating portion and at least partially penetrating the base portion to  
10 provide a roughening effect to the upper surface of the flooring material for enhanced slip resistance and protection from wear, the method comprising the steps of:-

- a) mixing together the components of the base portion;
- b) spreading the mixed components of the base portion on a surface;
- 15 c) applying at least one dressing of components of the coating portion in powder form to the components of the base portion to at least partially penetrate the base portion;
- d) applying at least one dressing of a first particulate material to the components of the base portion before or after applying the components of  
20 the coating portion in powder form;
- e) heating the powder coated base portion to cause the powder coating to form a film.

18. A method according to claim 17 wherein the components of the base  
25 portion form a paste when mixed.

19. A method according to claim 18 wherein the paste is spread on the surface at a controlled thickness.

20. A method according to claim 19 wherein a blade is used to spread the paste at a controlled thickness.
21. A method according to any of claims 17 - 20 wherein when the powder coated paste is heated the powder coating melts and flows to form the film.
22. A method according to any one of claims 17 - 21 wherein the components of the coating portion are applied to the paste while it is wet.
23. A method according to any one of claims 17 - 21 further comprising gelling or curing the base portion before applying the components of the coating portion.
24. A method according to any one of claims 17 - 23 wherein some of the coating portion in powder form is mixed with the components of the base portion.
25. A method according to any one of claims 17 - 24 wherein a dressing of silicon carbide, silicas, aluminium oxide, emery or flint is added to the paste spread at a controlled thickness to confer further slip and wear resistance and give some aesthetic properties.
26. A method according to any one of claims 17 - 25 wherein the product is cured for 1-10 minutes at 150-220°C.
27. A method according to any one of claims 17 - 26 wherein the flooring material is embossed.



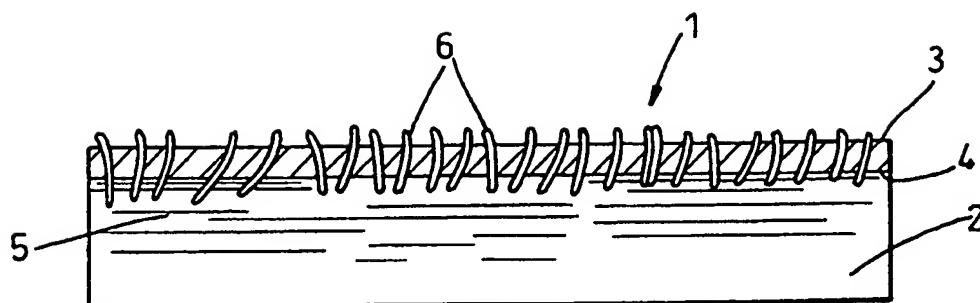
28. A method according to any one of claims 17 - 27 wherein the components of the coating portion in powder form are applied by a sprinkle system, a roller pick-up/brush off type system or a spray system.

5

29. A method according to any one of claims 17 - 28 wherein more than one application of the components of the coating portion in powder form takes place.

10 30. A method according to any preceding claim wherein more than one application of the first particulate material takes place.

1/1



*Fig. 1*

# INTERNATIONAL SEARCH REPORT

Int. No. PCT/GB 00/00056

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 7 E04F15/10 D06N7/00		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC 7 D06N E04F		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 475 951 A (LITZOW MERVYN R) 19 December 1995 (1995-12-19)  column 1, line 60 -column 2, line 48; figures 1,2	1,2,8, 10-12, 14-16
A	column 5, line 3 -column 6, line 39 ---	17
X	US 5 763 070 A (KERLEK JEROME G ET AL) 9 June 1998 (1998-06-09) column 1, line 65 -column 3, line 13; figures	1,2,10, 12,14-16
A	column 5, line 21 - line 37 column 6, line 5 - line 31 ---	17
A	US 2 010 025 A (H.P. KIRCHNER ET AL.) 6 August 1935 (1935-08-06) page 1, left-hand column, line 29 -page 2, left-hand column, line 51; figures ---	1,17
-/--		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
Date of the actual completion of the international search  12 May 2000		Date of mailing of the international search report  24/05/2000
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer  Pamies Ollé, S

# INTERNATIONAL SEARCH REPORT

Inventor's Name  
PCT/GB 00/00056

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 703 284 A (WATTS CHARLES EDWIN) 27 March 1996 (1996-03-27) page 4, line 30 - line 39; claims; figure page 5, line 20 -page 6, line 8 ---	1-3,12
A	EP 0 217 989 A (THOMPSON THOMAS L) 15 April 1987 (1987-04-15) abstract ---	1,2,12, 16,17
A	US 4 243 696 A (TOTH WILLIAM L) 6 January 1981 (1981-01-06) the whole document -----	1-3,12, 16,17

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/00056

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5475951 A	19-12-1995	NONE	
US 5763070 A	09-06-1998	NONE	
US 2010025 A	06-08-1935	NONE	
EP 0703284 A	27-03-1996	US 5431960 A	11-07-1995
EP 0217989 A	15-04-1987	US 4555292 A	26-11-1985
US 4243696 A	06-01-1981	NONE	

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

### **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**